RiHEI



Responsible and Impactful Universities as Sustainable Growth and Enterprise Catalysts in Georgia

Ecosystem transformation for sustainable and responsible job creation and enterprise

Toolkit 6

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FACULTY OF MANAGEMENT University of Lodz

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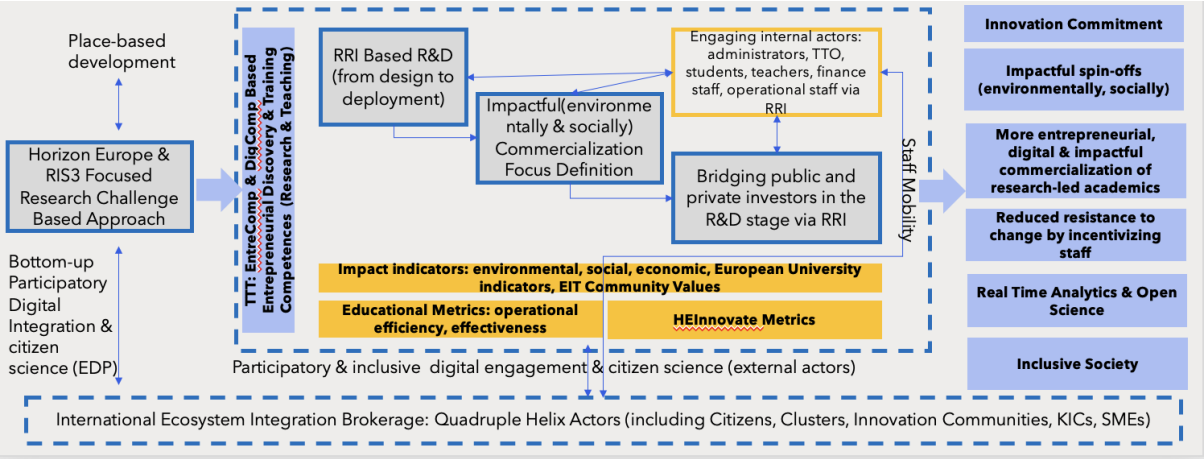
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Introduction

Ecosystem transformation for sustainable and responsible job creation and enterprise serves as a comprehensive guide designed to empower universities in Georgia and other regions to act as catalysts for sustainable growth and enterprise development. This document is a part of the broader Erasmus+ project, which focuses on transforming regional innovation ecosystems to foster responsible and impactful universities.

The instrument offers a strategic framework for integrating universities into the fabric of regional development, emphasizing their role in driving innovation, economic growth, and social engagement. By aligning with the New Horizon Missions and Regional Innovation Smart Specialization Strategies (RIS3), the instrument provides practical tools and methodologies that universities can adopt to enhance their cooperation with governmental bodies, support the growth of industrial clusters, and implement test beds and living labs. These elements collectively aim to strengthen the university's capacity to contribute meaningfully to regional development while ensuring that their research outputs are both impactful and aligned with societal needs.

This particular instrument focuses on the RiEcoLab Vision for ecosystem transformation. The RiEcoLab's vision for a commercially-oriented, research-led university is not only to excel in research and innovation but also to enhance its role as a successful teaching institution, where educators can effectively guide students toward entrepreneurship. Responsible Research and Innovation (RRI) plays a crucial role in this by engaging internal actors, including non-research-focused teaching staff, with commercially-oriented research. This engagement helps to boost their entrepreneurial skills and encourages them to adopt a more market-oriented approach in their teaching. Frameworks such as EntreComp and DigComp have already been utilized as Train-the-Trainer (TTT) tools for academic teachers, but there is potential to extend these frameworks to research and development units like the Ecosystem Integration Lab (EIL). By fostering an entrepreneurial mindset among innovation producers within the university, these tailored frameworks could significantly strengthen university entrepreneurialism and mobilize the broader innovation ecosystem.



Universities increasingly play a pivotal role in driving innovation and addressing complex societal challenges through targeted Research Challenge Calls, which are strategically aligned with initiatives such as the New Horizon Missions and Regional Innovation Smart Specialization Strategies (RIS3). These calls are designed not only to engage the university's internal research community but also to reach the broader quadruple helix community, which includes academia, industry, government, and civil society. This alignment with key missions and RIS3 areas ensures that research efforts are eligible for public investment, thus enhancing the potential for impactful outcomes. By broadening the scope of participation beyond internal staff, universities can leverage a wider range of expertise, perspectives, and resources, fostering more robust and innovative solutions to the challenges at hand.

At the heart of this integrative approach is the Ecosystem Integration Lab (EIL), a specialized unit within the university that acts as a central coordinating body for all research and development activities, including the crucial stages of commercialization. The EIL takes on a comprehensive role, orchestrating the research design and implementation process through the lens of Responsible Research and Innovation (RRI). This approach ensures that ethical considerations, societal impacts, and inclusivity are embedded in every stage of the research process. By involving internal actors such as managers, administrators, finance teams, educators, students, and ethics committees, the EIL fosters a collaborative environment where diverse perspectives contribute to the research outcomes. Moreover, the inclusion of external quadruple helix actors, such as industry partners, policymakers, and community organizations, further enriches the research process, ensuring that the solutions developed are grounded in real-world needs and are more likely to be adopted and scaled.

One of the critical functions of the EIL is the definition and implementation of impactful commercialization guidelines, which are essential for securing funding and ensuring the sustainability of research outcomes. These guidelines provide a framework for transitioning research innovations from the laboratory to the marketplace, emphasizing the importance of creating value for all stakeholders involved. To facilitate this transition, the EIL actively bridges public and private investors, fostering collaborations that lead to joint ventures or spin-offs. These ventures often involve partnerships between those who initially posed the research

challenge and the teams that developed and implemented the solutions. By aligning the interests of both public and private sectors, the EIL enhances the potential for successful commercialization, ensuring that innovations have a clear path to market and that they generate economic and societal benefits.

To measure the success of these initiatives, the EIL establishes concrete indicators that track the outcomes of research projects. These indicators are critical for evaluating the impact of the research and ensuring accountability to stakeholders, including funding bodies, investors, and the broader community. Additionally, the EIL promotes participatory engagement processes, integrating citizen science and open science methodologies to ensure that the research is transparent, inclusive, and reflective of societal needs. Citizen science initiatives, for example, involve the public in data collection, analysis, and even co-creation of research, thereby democratizing the research process and enhancing the relevance and impact of the outcomes. Open science practices further support this by making research findings accessible to a wider audience, encouraging collaboration, and fostering a culture of innovation that extends beyond the university walls.

Unit 1. Regional Innovation Ecosystem

Innovation has long been recognized as a driving force for economic growth, competitiveness, and societal progress (Liu et al., 2020). However, innovation does not occur in isolation; it requires a conducive environment that fosters creativity, collaboration, and the effective exchange of knowledge and resources. This environment, often referred to as an innovation ecosystem, is especially critical at the regional level (Klimas & Czakon, 2021). Regional innovation ecosystems play a vital role in harnessing local strengths, addressing specific regional challenges, and driving sustainable economic development. A regional innovation ecosystem refers to a network of interconnected organizations, institutions, and individuals within a specific geographic region that collectively contribute to the creation, diffusion, and application of new knowledge and innovations (Wiyono et al., 2022). These ecosystems encompass various actors, including universities, research institutions, businesses, government agencies, and civil society organizations. They operate within a defined regional boundary and leverage local resources, capabilities, and expertise to drive innovation and economic development (Klimas & Czakon, 2021).

The development of a region relies on its ability to create innovative solutions in both economic and social sectors (González-López & Asheim, 2020). Regions, however, are diverse, as are the elements that drive regional innovation (Rodríguez-Pose & Wilkie, 2019). A key tenet of the regional innovation system (RIS) approach is the inclusion of localized innovation networks rooted in specific sociocultural contexts (Isaksen et al., 2018). This is because geographical proximity is crucial for certain types of knowledge exchange and fostering trustful collaboration among stakeholders (Cooke, 2004). These innovation networks, comprising a triple helix of industry, university, and regional government, along with agencies and institutions, form the core components of a RIS, which are systemically interdependent (Asheim et al., 2019). Regional innovation ecosystems are also defined by geographic boundaries, such as cities, regions, or clusters. This spatial dimension allows for the concentration of resources, talent, and infrastructure within a manageable area (Thomas, Faccin, Asheim, 2021).

Collaboration and networking are fundamental to regional innovation ecosystems. Effective communication and interaction among actors facilitate the exchange of knowledge, ideas, and resources, leading to the co-creation of innovative solutions. A crucial element in adopting the ecosystem concept is identifying its key actors. According to the triple helix model (Etzkowitz & Leydesdorff, 1997, 2000), the interactions among industry, government, and universities drive innovative performance. Expanding on this model, Carayannis and Campbell (2009) introduce a fourth helix: organized civil society, represented by users and

non-governmental organizations. These ecosystems comprise a diverse array of actors, including academic institutions, businesses, government bodies, non-profits, and intermediary organizations. Each actor plays a distinct role in the innovation process, contributing unique capabilities and perspectives. In this context, an innovation ecosystem can be defined as co-innovation networks where actors from organizations involved in knowledge production, wealth creation, and norm control interact to form co-evolving and interdependent relationships, both directly and indirectly, across geographical boundaries. These networks then integrate new ideas and approaches from various internal and external sources into a platform that generates shared values for the sustainable transformation of society (Cai et al., 2020). Unlike most commonly cited definitions of innovation ecosystems (Scafarto et al., 2019), this definition emphasizes three novel aspects of interactions in co-innovation networks: cross-sectoral, transnational, and indirect, drawing insights from innovation, geography, and biology studies.

Access to resources, including financial, human, and technological resources, is crucial for the functioning of regional innovation ecosystems. These resources enable research and development activities, support startups, and foster innovation-driven growth by providing the necessary foundation for innovation activities (OECD Reviews of Regional Innovation, 2023). An enabling institutional framework, comprising policies, regulations, and governance structures, supports and incentivizes innovation activities. Regional policies often focus on creating a favorable business environment and promoting research and innovation, which are essential for sustainable regional growth (NBER, 2023).

The flow of knowledge and information within the ecosystem is critical for innovation, involving the transfer of scientific and technical knowledge, market insights, user needs, and societal challenges. This interconnectedness enhances the overall innovative capacity of the region (MIT D-Lab, 2019). A culture of entrepreneurship and risk-taking is also essential for fostering innovation, as it encourages the development of startups and supports the commercialization of research outcomes (Federation of American Scientists, 2023). Smart specialization, which involves identifying and leveraging regional strengths and competitive advantages to focus innovation efforts on specific sectors or technologies, further enhances the effectiveness of regional innovation policies, ensuring that resources are utilized optimally (OECD Reviews of Regional Innovation, 2023).

1.1. Importance of Regional Innovation Ecosystems

Regional innovation ecosystems play a pivotal role in promoting economic growth, job creation, and social well-being. These ecosystems enable regions to harness their unique strengths, respond to local challenges, and compete in the global economy. By fostering innovation, regional ecosystems drive economic diversification, attract investment, and create high-value jobs, contributing to overall regional prosperity. They also enhance resilience by enabling regions to adapt to changing economic and technological conditions, providing the flexibility needed to respond to disruptions and capitalize on emerging opportunities (Bristow & Healy, 2017). Effective regional innovation ecosystems promote inclusivity by engaging a wide range of stakeholders, including marginalized communities, ensuring that the benefits of innovation are broadly shared. Sustainable innovation practices within these ecosystems address environmental challenges and promote green technologies, contributing to long-term environmental sustainability (Farinha et al., 2020). Additionally, these ecosystems facilitate the generation and diffusion of knowledge, leading to continuous learning, skill development, and technological advancements, which are essential for maintaining a competitive edge in the global market (Zhao et al., 2024).

Regional innovation ecosystems are vital for driving economic growth, competitiveness, and societal progress. These ecosystems are characterized by geographic boundaries, diverse actors, collaboration, resource availability, institutional frameworks, knowledge flow, entrepreneurial culture, and smart specialization (Doloreux & Parto, 2005). Universities play a central role in shaping regional innovation ecosystems through their third mission, entrepreneurial activities, and social engagement (Peris-Ortiz et al., 2016).

Smart specialization enhances the effectiveness of regional innovation ecosystems by focusing on regional strengths and competitive advantages. It promotes economic diversification, increased competitiveness, enhanced innovation capacity, attraction of investment, talent development, and sustainable development (OECD, 2024).

By fostering a conducive environment for innovation, regional innovation ecosystems enable regions to harness their unique strengths, address local challenges, and compete in the global economy (Huggins & Williams, 2011). The collaborative efforts of universities, industry, government, and civil society are essential for realizing the full potential of these ecosystems and achieving sustainable and inclusive growth (World Economic Forum, 2022).

1.2. The Role of Universities in Shaping Regional Innovation Ecosystems

Universities have long been recognized as critical players in fostering regional innovation and economic growth, with their multifaceted roles extending far beyond traditional teaching and research functions. At the core of this transformative shift is the concept of the "third mission" of universities, which encompasses their active engagement with the wider community, industry, and policymakers to drive societal and economic impact (Čajka et al., 2023). This section explores the evolving role of universities, focusing on the university's third mission, the concept of the entrepreneurial university, and the engaged university's social purpose.

The entrepreneurial university model has emerged as a prominent approach, where institutions proactively nurture an environment that supports innovation, entrepreneurship, and commercialization of research outcomes (Santos et al., 2016). This involves not only developing specialized programs and infrastructure to cultivate entrepreneurial mindsets and skills among students, but also strengthening the university's own capacity to engage in technology transfer, patent registration, and the creation of spin-off companies (Peris-Ortiz et al., 2017). Moreover, the engaged university model highlights the importance of universities' social purpose and their role in addressing regional challenges (Čajka et al., 2023). This may involve activities such as providing continuous education and workforce training, collaborating with local governments and industries, and contributing to the development of healthy and vibrant communities.

As universities evolve to embrace these multifaceted responsibilities, they become critical institutional drivers of regional innovation ecosystems (Čajka et al., 2023).

1.3. University Third Mission

The third mission of universities refers to their role in contributing to socio-economic development, complementing their primary missions of education (first mission) and research (second mission). This third mission encompasses a broad range of activities aimed at generating societal impact, driving innovation, and supporting regional development. A critical aspect of this mission is knowledge transfer and technology transfer, where universities play a crucial role in transferring knowledge and technology to industry and society through activities such as patenting, licensing, and commercialization of research outcomes. Technology transfer offices (TTOs) within universities facilitate these processes by connecting academic researchers with businesses and entrepreneurs (Perkmann et al., 2013; Rasmussen & Borch, 2010). Industry collaboration is another key aspect, as partnerships

between universities and industry drive innovation through joint research projects, consultancy, and contract research, providing businesses with access to cutting-edge knowledge and expertise (Ankrah & AL-Tabbaa, 2015; Perkmann & Walsh, 2007).

Moreover, universities support entrepreneurship through initiatives like business incubators, accelerators, and entrepreneurship education programs, which equip aspiring entrepreneurs with necessary skills, resources, and mentorship to start and grow their ventures (Guerrero & Urbano, 2012; Rothaermel et al., 2007). Lifelong learning and continuing education programs offered by universities are vital for upskilling and reskilling the workforce, especially in regions undergoing economic transitions or facing skills shortages (Brennan et al., 2004; OECD, 2007). Additionally, universities engage with local communities through various outreach programs that address societal challenges and promote social cohesion, such as public lectures, cultural events, and community service projects (Benneworth & Jongbloed, 2010). Finally, universities contribute to regional development by providing policy advice, conducting regional economic analyses, and participating in regional development initiatives, leveraging their expertise to inform policy decisions and shape regional innovation strategies (Goddard & Vallance, 2013; Uyarra, 2010).

1.4. Entrepreneurial University

The concept of the entrepreneurial university has gained prominence as universities increasingly recognize their role in fostering innovation and entrepreneurship. An entrepreneurial university fosters a culture of innovation, creativity, and risk-taking, encouraging students, faculty, and staff to explore entrepreneurial opportunities and pursue innovative projects. It provides comprehensive support for startups and spin-off companies, including access to incubation facilities, seed funding, mentorship, and networking opportunities (Guerrero & Urbano, 2012). Entrepreneurial universities also integrate entrepreneurship education into their curricula, offering courses and programs that teach students the skills needed to start and manage businesses, emphasizing experiential learning through activities like hackathons and business plan competitions (Rasmussen & Sørheim, 2006).

Strong partnerships with industry are a hallmark of entrepreneurial universities. These partnerships facilitate the transfer of knowledge and technology, provide real-world learning experiences for students, and open up commercialization opportunities for research outcomes (Perkmann & Walsh, 2007). Entrepreneurial universities encourage interdisciplinary research that addresses complex societal challenges and leads to innovative

solutions, promoting collaboration across different academic disciplines to foster creativity and innovation (Etzkowitz & Leydesdorff, 2000). Furthermore, these institutions offer incentives and recognition for entrepreneurial activities, including financial rewards, promotion criteria that value entrepreneurial achievements, and awards for innovation and entrepreneurship (O'Shea et al., 2007).

Similarly, the engaged university concept emphasizes the social responsibility of universities and their commitment to addressing societal challenges and promoting social justice. Engaged universities actively collaborate with local communities, government agencies, and non-profit organizations to create positive social impacts. They prioritize community engagement by working closely with local communities to understand their needs and co-create solutions through participatory research, community-based projects, and public service initiatives (Watson et al., 2011). Engaged universities are at the forefront of social innovation, leveraging their research capabilities and resources to tackle issues such as poverty, inequality, and environmental sustainability (Benneworth et al., 2009).

Moreover, an engaged university promotes inclusive education by ensuring that educational opportunities are accessible to all segments of society, supporting underrepresented groups, providing scholarships, and creating pathways to higher education (Marginson, 2011). These universities also actively participate in policy advocacy, using their research and expertise to influence public policy and drive systemic change by engaging in dialogue with policymakers and contributing to the development of evidence-based policies (Goddard & Vallance, 2013). Lastly, engaged universities align their activities with the United Nations Sustainable Development Goals (SDGs), addressing global challenges such as climate action, quality education, and gender equality, integrating sustainability into their teaching, research, and community engagement efforts (Sachs et al., 2019).

1.5. The Role of Smart Specialization in Shaping Regional Innovation Ecosystems

Smart specialization is a strategic approach to regional innovation that focuses on identifying and leveraging a region's unique strengths and competitive advantages. It involves prioritizing specific sectors, technologies, or industries where the region has the potential to excel and achieve a competitive edge. Smart specialization aims to enhance the efficiency and effectiveness of regional innovation policies by concentrating resources and efforts on areas with the highest potential for impact (Foray et al., 2018; McCann & Ortega-Argilés, 2016).

The Entrepreneurial Discovery Process (EDP) is a central element of smart specialization. It involves stakeholders from academia, industry, government, and civil society collaborating to identify regional strengths, opportunities, and innovation niches. This bottom-up process ensures that smart specialization strategies are grounded in local knowledge and capabilities (Gianelle et al., 2016). Smart specialization encourages regions to focus on niche areas where they can achieve a competitive advantage by identifying specific sectors, technologies, or value chains that align with the region's strengths and have high impact potential (Balland et al., 2019). Additionally, it relies on data and evidence to inform decision-making. Regions conduct rigorous analyses of their economic structure, innovation potential, and market trends to identify strategic priorities and allocate resources effectively (Rodríguez-Pose & Wilkie, 2017).

Policy alignment is another critical aspect, requiring the coordination of regional policies and investments with identified priorities. This includes aligning funding, regulatory frameworks, and support programs to create a conducive environment for innovation in targeted areas (Kroll, 2016). Collaboration and innovation are at the heart of smart specialization, with regions fostering partnerships between academia, industry, and government to drive research and development, knowledge transfer, and commercialization in the chosen niches (Crescenzi et al., 2019). Continuous monitoring and evaluation are essential for assessing the progress and impact of smart specialization strategies. Regions track key performance indicators, measure outcomes, and make adjustments as needed to ensure the effectiveness of their initiatives (Magro & Wilson, 2019).

Smart specialization has a transformative impact on regional innovation ecosystems by driving targeted innovation, enhancing competitiveness, and fostering sustainable development. It promotes economic diversification by encouraging regions to develop new industries and value chains based on their unique strengths, reducing dependency on traditional sectors and enhancing economic resilience (McCann & Soete, 2020). By focusing on areas where they have a competitive advantage, regions can enhance their competitiveness in the global market, enabling the development of high-value products, services, and technologies that differentiate them from other regions (Tödtling & Trippl, 2018).

Smart specialization builds regional innovation capacity by fostering collaboration, knowledge exchange, and research and development in strategic areas, leading to the creation of innovative solutions, technologies, and business models (Carayannis et al., 2018). Regions with well-defined smart specialization strategies are more attractive to investors and businesses, as the focus on specific niches and the presence of a supportive innovation

ecosystem create favorable conditions for investment and business growth (Radosevic & Stancova, 2018). Furthermore, smart specialization strategies prioritize the development of skills and talent in targeted areas by aligning educational programs with industry needs, promoting STEM (science, technology, engineering, and mathematics) education, and offering training and upskilling opportunities (Aranguren et al., 2019). Finally, smart specialization contributes to sustainable development by promoting green technologies, resource efficiency, and environmentally friendly practices, allowing regions to leverage their strengths to address sustainability challenges and create a positive environmental impact (Mariussen et al., 2019).

Important: while smart specialisation is a strong tool for regional development, it is important to understand that academic freedom is of upmost importance to maintain the traditional views of open academia. Therefore, the RiHEI approach promotes the idea of aligning university applied research to smart specialisation areas of the regions, however without completely disregarding other disciplines as well as theoretical research as well. Naturally, more funding will be made available for areas that provide direct market benefit, however, academic freedom should never be compromised.

1.6. Examples of strong performing regional innovation ecosystems in the EU:

The regions listed below exemplify the benefits of strong regional innovation ecosystems, including economic diversification, increased competitiveness, and enhanced innovation capacity. Their success is underpinned by strategic investments in research and development, robust public-private partnerships, and targeted support for high-impact sectors. These investments facilitate the creation of advanced infrastructure, such as state-of-the-art laboratories and innovation hubs, which provide the necessary resources and environment for cutting-edge research and development. Robust public-private partnerships leverage the strengths of both sectors, ensuring a continuous flow of ideas, knowledge, and technology between academia and industry. This collaboration not only accelerates the commercialization of research outcomes but also ensures that innovation activities are aligned with market needs and societal challenges. Additionally, targeted support for high-impact sectors includes financial incentives, regulatory support, and specialized training programs, all designed to foster growth in areas with the highest potential for economic and social impact. This comprehensive approach ensures that regional innovation ecosystems remain competitive and capable of driving sustained economic growth and development (Regional innovation scoreboard, EC, 2023; Peiffer-Smadja et al., 2023).

1. Lombardia, Italy:

Lombardia is recognized as one of Europe's leading innovation regions. It is characterized by its high level of industrialization, a robust network of universities and research institutions, and strong public-private partnerships. The region excels in sectors such as advanced manufacturing, life sciences, and digital technologies. Initiatives like the Lombardy Technological Cluster for Aerospace and Lombardy Green Chemistry Association illustrate its commitment to fostering innovation through specialized clusters. Lombardia's success is driven by a strategic focus on smart specialization, aligning regional strengths with high-impact innovation areas (Pontikakis, et al., 2022).

2. Stockholm, Sweden:

Stockholm is consistently ranked as one of Europe's most innovative regions. It benefits from a strong entrepreneurial culture, significant investments in research and development, and a high concentration of tech startups. The region is known for its excellence in ICT and life sciences, bolstered by institutions like the KTH Royal Institute of Technology and Karolinska Institute. Stockholm's innovation ecosystem is supported by a collaborative environment that promotes knowledge sharing and commercialization of research outcomes (European Innovation Scoreboard, EC, 2024).

3. Helsinki-Uusimaa, Finland:

The Helsinki-Uusimaa region is another top performer, known for its strong digital economy and sustainable innovation practices. The region hosts several world-class universities and research centers, including Aalto University and the University of Helsinki, which drive innovation through interdisciplinary research and industry collaboration. The area's focus on clean technologies and smart city solutions positions it as a leader in sustainable development and digital innovation. (Regional innovation scoreboard, EC, 2023).

4. Oberbayern, Germany:

Located in Bavaria, Oberbayern is a hub for high-tech industries and research institutions. The region is home to major companies like Siemens and BMW, as well as renowned universities such as the Technical University of Munich. Oberbayern excels in fields like automotive technology, aerospace, and biotechnology. The strong linkages between industry, academia, and government in Oberbayern foster a dynamic innovation ecosystem that drives regional and national economic growth (European Innovation Scoreboard, EC, 2024).

1.7. Tools that measure the progress/growth of regional ecosystems

Measuring the progress and growth of regional ecosystems is crucial for informed policy-making and sustainable development. Several tools and indices have been developed to assess various dimensions of regional growth, including competitiveness, human development, innovation, entrepreneurship, and smart specialization. These tools provide comprehensive data and insights, helping regions identify strengths, address weaknesses, and formulate strategies for economic and social improvement. The key tools described below include the EU Regional Competitiveness Index, Human Development Index, European Innovation Scoreboard, Global Entrepreneurship Monitor, and the Smart Specialisation Platform.

1. EU Regional Competitiveness Index (RCI) 2.0 (2022 Edition)[1]

The EU Regional Competitiveness Index (RCI) 2.0, updated in 2022, is a tool designed to measure the competitiveness of regions within the European Union. Competitiveness, in this context, is defined as the ability of a region to offer an attractive and sustainable environment for both businesses and residents. The RCI evaluates regions based on factors like human capital, infrastructure, innovation, and quality of institutions, aligning with the World Economic Forum's framework for national competitiveness but tailored for regional analysis within the EU. This index uses a variety of indicators, updating its methodology periodically to ensure relevance and accuracy. Interactive tools and scorecards provide comparisons across regions, enhancing the index's utility for policy-making and regional development planning.

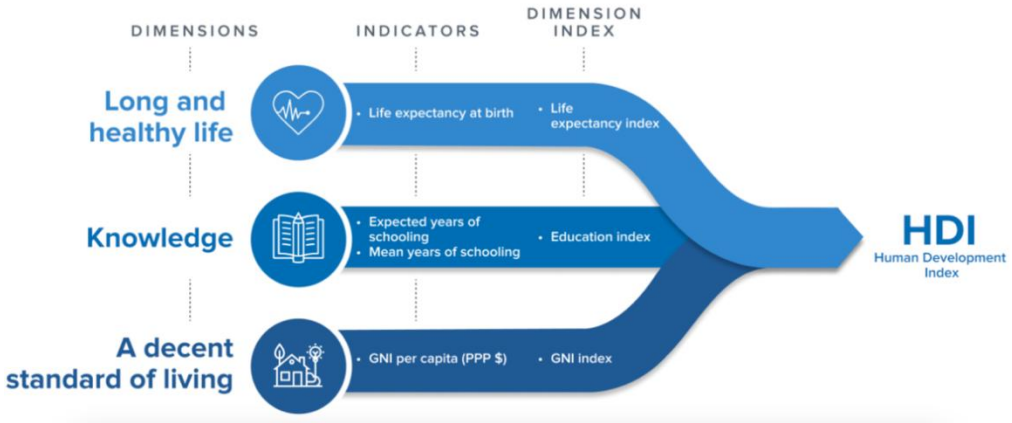


[1] https://ec.europa.eu/regional_policy/assets/regional-competitiveness/index.html#/

Front page of the EU Regional Competitiveness Index 2.0 - 2022 edition: https://ec.europa.eu/regional_policy/information-sources/publications/working-papers/2023/eu-regional-competitiveness-index-2-0-2022-edition_en

2. Human Development Index (HDI)[2]

The Human Development Index (HDI), developed by the United Nations Development Programme (UNDP), is a comprehensive tool that measures a region's average achievements in three basic aspects of human development: health (life expectancy), education (mean years of schooling and expected years of schooling), and standard of living (GNI per capita). The HDI provides a composite measure of these dimensions, allowing for comparisons across different regions and over time. It emphasizes the broad spectrum of human well-being beyond economic growth, encouraging policies that focus on sustainable and inclusive development. The HDI is a pivotal tool in identifying areas needing improvement and tracking progress in human development globally.



HDI Index graph, taken from: https://hdr.undp.org/data-center/human-development-index#/indicies/HDI

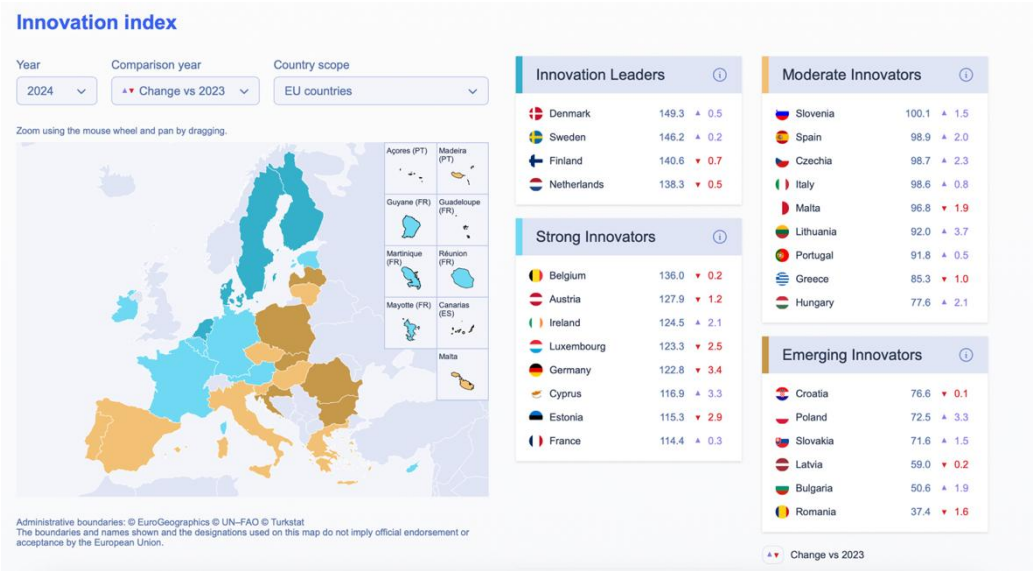
3. European Innovation Scoreboard (EIS)[3]

The European Innovation Scoreboard (EIS) is an analytical tool that assesses the innovation performance of EU member states and selected third countries. It uses a broad set of

[2] https://hdr.undp.org/data-center/human-development-index#/indicies/HDI

[3] https://projects.research-and-innovation.ec.europa.eu/en/statistics/performance-indicators/european-innovation-scoreboard/eis-2024#/

indicators covering framework conditions, investments, innovation activities, and impacts to provide a comprehensive overview of innovation dynamics. The EIS helps policymakers and stakeholders identify strengths and weaknesses in national innovation systems, informing strategies to enhance innovation capacity. The scorecard offers detailed insights into various dimensions such as human resources, attractive research systems, finance and support, firm investments, and intellectual assets, making it an essential tool for fostering competitive and innovative ecosystems in Europe.



Taken from: https://projects.research-and-innovation.ec.europa.eu/en/statistics/performance-indicators/european-innovation-scoreboard/eis-2024#/eis

4. Global Entrepreneurship Monitor (GEM)[4]

The Global Entrepreneurship Monitor (GEM) provides a detailed analysis of entrepreneurial activities, attitudes, and aspirations across various regions. By surveying a wide array of individuals and institutions, GEM captures the multifaceted nature of entrepreneurship, including the motivations, demographics, and impact of entrepreneurs. The tool's comprehensive framework includes indicators like entrepreneurial behavior and attitudes, national context, and socio-economic development. GEM's data is invaluable for understanding the entrepreneurial landscape, fostering supportive policies, and promoting sustainable economic growth through entrepreneurship. This global initiative aids in identifying trends and informing strategic decisions to enhance entrepreneurial ecosystems.

[4] https://www.gemconsortium.org



Taken from the front page of the GEM 2023/2024 GLOBAL REPORT - 25 YEARS AND GROWING: https://gemconsortium.org/report/global-entrepreneurship-monitor-gem-20232024-global-report-25-years-and-growing

5. Smart Specialisation Platform (S3 Platform)[5]

The Smart Specialisation Platform (S3 Platform) is an initiative by the European Commission to assist regions in developing and implementing their Research and Innovation Strategies for Smart Specialisation (RIS3). This tool supports regions in identifying unique strengths and opportunities, fostering innovation-driven growth. The platform provides a wealth of resources, including data, best practices, and analytical tools, facilitating the design and monitoring of smart specialisation strategies. By promoting collaboration and knowledge exchange, the S3 Platform aims to enhance regional competitiveness and innovation capacity, driving sustainable economic development tailored to regional contexts.



Taken from: https://s3platform.jrc.ec.europa.eu

[5] https://s3platform.jrc.ec.europa.eu

Unit 2. Instruments for universities to become socially engaged

The following cross-sectoral instruments show various cross-sectoral examples of how universities can engage with external stakeholders in order to better shape talent ecosystems and therefore, boost job creation. The role of the instruments is to have a demonstrative purpose.

Instrument 1	**Design Thinking for Co-design Public Open Spaces**
Short description	Designed as a practical guide, the Design Thinking instrument provides a comprehensive approach to help users overcome challenges and identify opportunities in the co- design of public open spaces. It is based on the principles of Design Thinking and offers a range of strategic tools and actionable steps aimed at delivering integrated solutions through measures that include identifying stakeholders and understanding the needs of the local community. It then guides users through a dynamic process that includes empathy, identification and definition, research and planning, implementation, testing, and evaluation phases. Targeting doctoral candidates, researchers, and professionals working at the intersection of life sciences, urban well-being, and urban planning, the main goal of the instrument is to enable users to facilitate and optimize co-design processes in close collaboration with local communities and stakeholders. These efforts aim to positively transform the urban environment and improve the quality of urban life.
Target group(s)	The instrument is tailored for doctoral candidates, researchers, and professionals specializing in urban planning and revitalization, environmental and urban studies, urban well-being, and community-oriented co-design. Moreover, its scope extends to city staff and nonprofit organizations dedicated to enhancing the quality of urban livability within their respective communities.
Benefit for target group(s)	The benefit of the instrument for the target audience is that it harnesses the versatile and non-traditional problem-solving methods of Design Thinking, which can be applied across a wide range of disciplines and challenges. By applying Design Thinking methods, users acquire holistic skills to identify and solve human-centered challenges, drive innovation, and adapt to different problem-solving scenarios.

Measures	The measures encompass the development of a holistic approach rooted in Design Thinking, emphasizing human- centered design principles for co-designing public open spaces. This approach advocates for a comprehensive assessment of the needs and aspirations of the local community, involving the provision of a range of unconventional tools and strategies to foster the generation of new ideas and concepts across the phases of empathy, identification and definition, research and planning, implementation, testing, and evaluation. In simpler terms, these measures are crafted to facilitate the co-design process and the conversion of novel ideas and concepts into feasible solutions. Additionally, the measures involve the creation of templates and recommendations for documenting the co- design process and its outcomes, facilitating knowledge sharing, and disseminating best practices among professionals and communities.
Expected outcome(s)	The expected outcome is a Design Thinking instrument that provides a systematic, step-by-step framework for applying Design Thinking to the co-design of public open spaces. It is expected that successful implementation will result in a practical downloadable guide that will serve as a versatile resource for workshops, research endeavors, and real-world projects on the topic addressed. Ultimately, it is expected that effective use of the instrument will result in tangible improvements in public open spaces through community and stakeholder collaboration while contributing to academic and professional advancement in the realms of co-design, urban planning, and urban well-being.
Specific activities and resources required	Several specific activities are required to develop the Design Thinking instrument. These include in-depth research on Design Thinking methods, best practices for urban planning and public open spaces, and urban well-being. Relevant content, case studies, and examples will be compiled for the instrument. A clear framework will be designed to outline the step- by-step co-design process and tools. Content will be created to explain Design Thinking concepts, provide guidance for activities, and engage stakeholders. Templates, worksheets, and tools will be developed for each phase of the Design Thinking process (e.g., empathy maps and brainstorming sheets), for which visually appealing layouts with graphics and diagrams will be designed. In addition, the Design Thinking instrument will be tested in a small group to gather user feedback. Content will be reviewed and edited for accuracy and accessibility.

	Resources required include expertise in Design Thinking, urban planning, and content development; access to research materials such as academic papers and case studies; use of content creation tools, graphic design, and user testing; and sufficient time and staff for research, development, and refinement.
How should it look on the website? What format does the tool have?	The presentation of the Design Thinking instrument on the website should be visually appealing and organized for easy navigation and use. It should begin with an introduction to its purpose and benefits, and then be divided into user-friendly sections, each corresponding to a phase of the Design Thinking process. Therefore, it can be made available on the website as a practical guide with the possibility to download tools, templates sheets, and resources for each phase. Offering the instrument in both an interactive digital format and a printable PDF format would enhance the user experience and meet multiple needs, users could access additional reading materials and support. In addition, the website design should mensure a seamless user experience and feature consistent imagery. Template sheets for use in the co-design processes Links to possible (open access) tools to implement engagement of stakeholders into co-design process
Key factors for success	The success of the instrument relies on key elements that enhance its effectiveness and widespread use. These factors encompass a solid foundation in Design Thinking principles, fostering empathy and innovation, as well as stakeholder engagement and community participation, which play a pivotal role in ensuring that diverse perspectives shape the co- design process. The practical guide, along with digital and printable resources, caters to different user types, thereby promoting learning and the sharing of ideas. Its clear communication and user-friendly templates are also key factors contributing to its success, as they facilitate understanding and application. In essence, the instrument's success thrives on its holistic, user-centered, and collaborative approach, built upon practical resources, effective communication, and an unwavering commitment to ongoing improvement.
Implementation field	The implementation field entails the practical realization and execution of participatory co-design processes for public open spaces in urban, peri-urban and extra-urban (rural) contexts (e.g., green

	spaces and public squares). This includes translating collaborative ideas and concepts into tangible, functional, and aesthetically pleasing physical spaces that meet the needs and aspirations of local communities and stakeholders.
Other tools suitable for combination	• Promote Your Research Communication • Visual Methodologies for Landscape Observatory

Instrument 2	**Promote your Research Communication**
Short description	This instrument would be comprising user-friendly guidelines designed to assist researchers in promoting their findings, primarily through social media. The guidelines would offer best practices for creating engaging posts, selecting appropriate channels, leveraging visual aids, using keywords or hashtags for increased visibility, and tailoring communication for diverse audiences.
Target group(s)	• Early career researchers • Institution (teaching and research staff)
Benefit for target group(s)	• Greater relevance, accountability and transparency of research outcomes • Making ECR research more visible in the field • Enhance reputation and impact of research • Opportunity in obtaining research fundings • Reaching the stakeholders • Informing, raising awareness of science-related topics • Getting involved with audiences including people from outside the science community • Science embedded in the daily life

Measures	• Guideline will be formed of two chapters: academic communication and public communication • Main contents of the guideline will include • Steps to be undertaken before publication (Keywords, title, and abstract, Journal search, ORCID profile) • Promote you research (social media promotion (Twitter, ResearchGate, Academia, ScienceOpen, My Science Work), videos creation, graphical abstracts, promotion at conferences, data sharing, email signature, blogging, press release) • Monitoring of the impact (Almetrics) • Identification of stakeholders relevant for the field of the research
Expected outcome(s)	• Increasing research visibility • Widing opportunities for fundings, trainings, workshops • Use of institutional repository for supporting open science • Long term positive effects of scientific results and achievements • Improvement of goals or focus of the research • Bringing citizens closer to science (research outputs) • Influencing people's attitudes and behaviors
Specific activities and resources required	• Mentorship programme informed • Visibility on the website of the institution • Use of digital technologies for methodologies such as storytelling, persuasion etc.
How should it look on the website? What format does the tool have?	Tool will be in the form of the interactive tool on the website which will lead each user to the written Guidelines which will include previously published links and videos will be attached
Key factors for success	• Detailed information given in the Guideline • Promote Guideline to the ECR through website of institution, and other tools (Mentorship programme, Academic Bridge) • Research that is responsive to societal needs and interests

Implementation field	• Provide to ECR with company profile cards where they can promote their research • Provide ECR with trainings on how to promote their research • Supporting institutional repository
Other tools suitable for combination	Academic Bridge

Instrument 3	**Visual Methodologies for Landscape Observatory**
Short description	Visual Methodologies for Landscape Observatory is a training course for implementing and utilizing visual instruments to work and communicate with the community and interested stakeholders on spatial and landscape planning approaches to landscape enhancement and raising the quality of life. It is an approach to unifying the production of art and visual communication methods to scientific production and landscape research. Visual methodologies use various means of artwork as visual presentation tools - photographs, illustrations, pictograms, and drawings as well as storytelling and video materials to engage community and stakeholders in scientific research and landscape planning. The implementation of visual methodologies empower young scientists, the community, and stakeholders to communicate and mutually share their knowledge, ideas, views, and needs on inherited landscape values to foster contextual research of landscape. Visual methodologies contribute to developing the Landscape Observatory framework and widening the Landscape Observatory network. The theoretical framework for the use of visual methodologies is the Landscape Observatory. Landscape Observatory is a network of institutions and stakeholders, a space for experience exchange on the dynamic equilibrium, interactions, and transformations between natural and anthropogenic networks. The concept of landscape is understood as an interaction between natural and cultural networks as well as the interrelation of natural and cultural assets and their context. The spatial scope of Landscape Observatory is oriented on the Mediterranean Europe landscape settings of the intense

	interaction between coast and inland that include natural connections of river, valley, hill, and mountain habitats and biodiversity to cultural-historical, functional, and symbolical connections. The training course Visual Methodologies for Landscape Observatory is focused on the use of visual arts in developing storytelling of scientific achievement or the metaphoric presentation of research methods or results. The aim is to make communication between local administrators, urban and spatial planners, and the community more friendly and to make the process of analyzing and planning territories more collective.
Target group(s)	• The target groups include various stakeholders interested in the topics of territorial planning, enhancement of ecological and societal landscape networks, as well as raising the quality of living: • Young researchers dealing with spatial topics within the life sciences, • Spatial planners, architects, and other professionals involved in the process of planning and analyzing the territory, both in the landscape and in the urban context, • Administrators who want to participate in the planning process of a territory in a collective project, • Community and locally engaged organisations, • Small and medium-sized enterprises (SMEs) active locally.
Benefit for target group(s)	The general benefit to all involved groups is empowerment to communicate their knowledge, ideas, views, and needs on inherited landscape values as well as gathering new knowledge from other groups. The benefit for architects and planners will be double - firstly, they can get more input from the population and all communities involved in the planning, and secondly, they can offer a clearer idea of their design choices during planning development. For citizens and administrators, the benefit will be knowledge of the issues involved in the planning process and a more integrated awareness of planning development
	The aim is to make communication between local administrators, urban and spatial planners, and the community more friendly and to

Measures / activities	make the process of analyzing and planning territories more collective. The development of a trans-European network of Landscape Observatory answers the need to monitor landscape transformations, analyse new ways of establishing coastal and inland landscape relations, as well as to exchange experience with institutions and stakeholders active in the field of promoting, evaluating, and governing landscapes. The aim is to create a platform for collecting information about the relation transformations of coastal and inland territories within Mediterranean Europe.
Expected outcome(s)	The main expected result is to organize a virtuous exchange in the territorial planning process, between researchers, planners, administrations, and the population. This exchange, which has not been very linear and participatory up to now, could, through the training of experts specialized in the communication of project analyzes and choices, be an important element of participatory planning and of the sharing by the communities of design choices for their future.
Specific activities and resources required	In order to train experts in communication through visual methodologies, it will be necessary to organize specific workshops, articulated on experimental processes, coordinated by experts in different sectors, from storytelling to videomaking, from photography to ideogrammatic and iconic drawing. These workshops will also be open to observers other than the professionals they are aimed at, to keep an open response to the needs of the broader targets identified by the process, even during the workshop. The tools will be divided into two groups: the first concerns storytelling (with videos, sketches, animated drawings, etc.) to tell the greatest number of users about the designers' choices, overcoming the difficulties of common project representations. The second concerns the possibility of asking the population to participate in the analysis and planning of the landscape, making it easier for citizens to contribute (with synthetic diagrams, pictograms, mental maps, impressions, and so on).
	Overview of training course summary with training course topics / content and training material.

How should it look on the website? What format does the tool have?	Links to held / premade classes exploring topics of Visual Methodologies and Landscape Observatory. The tool can be presented by best practices examples of storytelling, artwork, pictograms that present the application of Visual Methodologies in scientific research and/or communicating to public. Map of Landscape Observatory network overviewing already included institutions and stakeholders (classification - educational institutions, public agencies, small & medium enterprises (SME), stakeholder organisations…) to promote the Landscape Observatory activities. Invitation to expand the network to all interested parties. Additional information on Landscape Observatory. Timeline of planned activities open for scientific / public engagement (possible to develop on the level of all tools and project activities).
Key factors for success	• Originality of using art and visual methodologies as a shared language for planning, observing, understanding cultural and natural landscape • Effective involvement of Quadruple Helix stakeholders in training, so that ECR and others are increasingly able to apply these new forms of communication and coordination • Continually updated best practices so that they inspire and stimulate more friendly communication of landscape practices among researchers, communities, and local government • Living exchange between all stakeholders by using several methods of communication and coordination
Implementation field	Field of territorial planning and spatial topics within the life sciences with the aim of enhancement of ecological and societal landscape networks, as well as raising the quality of living. Implementation regards open public spaces with local communities and stakeholders, in urban, peri-urban, and extra- urban environments focusing on green public areas and places of community as well as ecological importance.
Other tools suitable for combination	• Design Thinking for Co-design Public Open Spaces • Promote Your Research Communication

Instrument 4	(Human) Ecosystem Integration Lab
Short description	(Human) Ecosystem Integration Lab will serve as a digital instrument, found within a dedicated tab on the BETTER Life website. This tool is designed for the active participation of Quadruple Helix stakeholders—universities, businesses, administrations, and NGOs—in engaging with the community. Its focus lies in facilitating discussions and collaborations related to research in life sciences. Among the key features of this tab, Quadruple Helix stakeholders, including the ERC (early career researchers), will have the ability to submit concise abstracts with pre- defined keywords associated with their research concepts and areas of interest. Inclusive of functionalities such as a forum, the option to create user profiles (including information such as name, email, affiliation, research field and age), the (H)EIL aims to streamline the ERC's professional growth and advancement within their research career.
Target group(s)	Quadruple Helix stakeholders — universities (ECR), businesses, administrations, and NGOs
Benefit for target group(s)	Efficient Collaboration: enables Quadruple Helix stakeholders to easily connect and collaborate with each other in order to share insights, expertise, and resources, fostering interdisciplinary collaborations that can lead to innovative solutions. Research Dissemination: allows stakeholders to share their research ideas and concepts through short abstracts and keywords which can lead to the rapid dissemination of research topics to a broader audience. Enhanced Visibility: Quadruple Helix stakeholders can showcase their expertise and interests through the platform, enhancing their visibility within the community.
	• Defining the concept and purpose of the (H)EIL tab. • Determining the features and functionalities of the tab. • Planning the user experience.

Measures	• Establishing effective communication channels within the platform, such as forums and notifications. • Developing the actual (H)EIL platform according to the planned features and design. • Creating user registration and login systems, ensuring data security and privacy. • Implementing the research showcase functionality for uploading abstracts and keywords. • Building the collaboration hub, including forums and threads for discussions. • Testing the platform's functionality, security, and usability before launch. • Launching the platform and monitoring its usage, engagement, and impact.
Expected outcome(s)	**Knowledge Exchange and Learning** The platform's forums, discussions, and resources promote knowledge exchange and learning among stakeholders. Researchers can learn from each other's experiences, challenges, and successes, contributing to professional growth. **Enhanced Collaboration and Networking** (H)EIL aims to facilitate cross-sector collaboration among universities, businesses, administrations, NGOs, and researchers. Stakeholders can connect, share ideas, and form partnerships that lead to innovative research projects, interdisciplinary solutions, and collective impact. **Community Impact and Engagement** By connecting with NGOs and community representatives, (H)EIL can identify research areas with direct societal impact. Research outcomes can address pressing issues, contributing to community well-being and sustainable development.
	Define tab Requirements: • Activities: Collaborate with the consortium to gather users' requirements and preferences (internal surveys). • Resources: Task coordinator and team members

Specific activities and resources required	**Define Content** • Activities: Select research abstracts and populate the tab with content and users (research abstracts and users). • Prepare content for the tabs sections Resources: Task coordinator Content selectors **Develop the (H) EIL tab** • Activities: Develop the tabs interface, incorporating the defined design elements and collected content. • Resources: Task coordinator and team members CZU/MLU IT team
How should it look on the website? What format does the tool have?	The (Human) Ecosystem Integration Lab (H)EIL platform can be designed as a user-friendly and visually appealing online space (tab in the BL website). (H) EIL tab: welcoming interface with quick access to login or create an account; (H)EIL branding and navigation options (showcasing recent research, news, and upcoming events). Login/Registration: secure user authentication and registration process. Research Showcase: a section for users to upload research abstracts and associated keywords. Collaboration Hub: Interactive forum for discussions. Privacy and Security: clear privacy settings allowing users to control the visibility of their information. Online Tool and Interface: The tab is developed within the BETTER Life website accessible through standard web browsers. Use of Scales:

	Users can rate their satisfaction with different features, ease of navigation, or the quality of interactions. Research Showcase and Collaboration Hub: In the research showcase, users can submit open- ended abstracts about their research projects, highlighting key objectives and findings. Closed questions can be used to categorize the research under specific topics or fields of interest. The collaboration hub includes open-ended forum discussions where users can initiate conversations and pose questions.
Key factors for success	**Enhanced Collaboration and Networking** • (H)EIL aims to facilitate cross-sector collaboration among universities, businesses, administrations, NGOs, and researchers. • Stakeholders can connect, share ideas, and form partnerships that lead to innovative research projects, interdisciplinary solutions, and collective impact. **Knowledge Exchange and Learning** • The tab's forum and resources promote knowledge exchange and learning among stakeholders. • Researchers can learn from each other's experiences, challenges, and successes, contributing to professional growth. **Platform Evolution and Adaptation** • Based on user feedback and evolving research trends, (H)EIL can adapt its features and functionalities to remain relevant and impactful.
Implementation field	(H)EIL tab is designed to cater to Quadruple Helix stakeholders, including universities, businesses, administrations, NGOs, and researchers, who are involved in the life sciences. It aims to facilitate collaboration, knowledge exchange, and engagement within the life sciences research community and foster ECR development in the life science field.
Other tools suitable for combination	• Academic Bridge • Promote your Research Communication

Instrument 5	Academic Bridge
Short description	The proposed platform is a digital hub (website) designed to foster collaboration between municipalities (initially as stakeholders, with potential to include additional stakeholders operating in Quadruple Helix in the future) and researchers. Furthermore, the platform could serve as the foundation for an insightful academic paper focused on municipalities' willingness to collaborate with academia which would be dedicated to the project. The platform's design could be expanded to accommodate other stakeholders in addition to municipalities, and researchers could be given the capability to propose topics, further enhancing the platform's collaborative aspect. Consequently, it's not merely a matching service but a hub that fosters collective research endeavors.
Target group(s)	Early career researchers – as defined in the BETTER Life proposal. Moreover, the platform will be accessible to all academic researchers and students across various fields of research. Municipalities in all 8 countries of the consortium with potential for expansion to other countries. The initial target group will count all 6 254 municipalities in the Czech Republic which will serve as a pilot to other regions. Potential future expansion and extension: Other stakeholders operating in Quadruple Helix interested in socially engaged research (particularly in life sciences) and wanting to participate and utilize such kind of research.
	Municipalities: • Access to academic expertise and possibilities to consult their problems with academia. Municipalities can access data-driven insights and evidence-based recommendations from researchers, enabling them to make more informed decisions about policies, programmes, and projects. • Solutions to local issues backed by research. • Increased visibility of their challenges within the academic community. • Streamlining the bi-directional knowledge transfer between governance and science and research actors to enable a

Benefit for target group(s)	multi-actor approach to consultancy and problem-solving of local issues. • Innovation Acceleration: Collaboration with researchers can lead to innovative solutions that municipalities might not have otherwise considered. Researchers can bring fresh perspectives and cutting-edge ideas to address complex urban challenges. • Capacity Building: Interacting with researchers can contribute to the professional development of municipal employees. Exposure to research methodologies and problem-solving approaches can enhance the capacity of municipal staff to tackle challenges effectively. **Researchers:** • Direct insight into the real-world challenges faced by municipalities. Implementing research findings in real- world scenarios offers researchers a chance to validate their theories and models. • Opportunities for impactful and locally engaged research. Collaborating with municipalities provides researchers access to valuable real-world data sets, enriching the quality and relevance of their research. • Platform will showcase researchers´ expertise. • Publication Opportunities: Successful collaborations with municipalities can lead to compelling case studies or research papers that can be published. • Enhanced Funding Prospects: Demonstration of real-world impact through collaboration with municipalities can strengthen researchers' grant proposals and funding applications, as funding agencies increasingly emphasize practical applications and societal relevance.
Measures / activities	• Distributing surveys to municipalities to identify research interests and other potential areas of cooperation between academia and municipalities. • Developing a dynamic digital platform (website) with potential login to a members-only area. • Continuously updating the platform to maintain an active database of research interests.

	• Identifying the research interests of municipalities and governance actors through surveys.
Expected outcome(s)	• Establishment of a robust digital platform for sharing research topics and governance actors' queries. • Establishing lasting and meaningful relationships between stakeholder groups. • Increasing the exploitation of research results by governance actors and other stakeholder groups. • Identification and cataloging of pressing research topics from municipalities. • Fostering numerous research collaborations between municipalities and academia. • Creating applied research opportunities between the governance actors and academia.
Specific activities and resources required	**Activities:** • Survey creation: Creating a questionnaire to reach out to municipalities. The idea is to include questions about what issues are acute in the municipality and whether the municipality would like to connect with academics for specific research topics. • E-mail outreach: Reaching out to communities via email to identify potential research interests. The questionnaire would go to the official email address of the municipality (the contact email of municipalities should be publicly available information in every EU country). Alternatively, the outreach could take a different form - approaching specific persons according to different portfolios (in large cities) instead of an email address. • Digital platform development: Designing a platform to support collaboration between municipalities (as stakeholders) and researchers. • Stakeholder engagement sessions: Publishing data and results from communities to academics, laying the groundwork for possible collaborations between communities and the academy. Questionnaire data (data from specific municipalities with topics they would like to research) will be on a public website - ideally broken down by region and research topic, for example. Based on this,

	academics will be able to contact relevant stakeholders or vice versa. **Resources:** • Web development and hosting: Including software developers, designers, quality assurance/testers. • Survey tools • Content creators for platform resources • Legal advisor - to ensure that the platform complies with relevant data protection and privacy laws and to draft necessary terms of use and agreements (this will apply to the entire DCoE). • Project and data management
Key factors for success	• Effective outreach resulting in active participation from municipalities. • The platform's user-friendliness, coupled with its relevance to the needs of both municipalities and researchers. • Sustained engagement and regular updates to ensure the platform remains dynamic and up to date. • Examples of good practice / Promotion of success stories
Implementation field	Digital collaboration and research platform; partnerships between stakeholders (municipalities) and academia.
Other tools suitable for combination	• Promote your Research Communication • (Human) Ecosystem Integration Lab

Instrument 6	**A Boardgame for a better understanding of the advantages of collaboration**
Short description	BETTER Life's serious, educative boardgame allows participants to better understand the need for and advantages of collaboration amongst Quadruple Helix actors. The game focuses on teaching the importance of engaging science and cooperative initiatives to address and manage societal and environmental challenges. The players assume the role of a number of different organisational entities within the game scenario. Each player will have their own targets, while also striving to cooperate with other players to reach shared and communal goals. The goals within the game are aligned with the current EU Biodiversity Strategy 2030. Failure to reach goals will have

	negative consequences for all participants, but each player needs to finely balance how much of their in-game resources are allocated towards their own agenda and how much they want to contribute to common targets. The game is played in rounds. Each round represents a certain timeframe tied to the EU Biodiversity Strategy 2030. Within each round, players take turns rolling dice, playing action cards or triggering events that can be both positive or negative. The game ends after the year 2030 has passed, after which communal and individual goals will be evaluated to determine who managed to allocate their resources most efficiently.
Target group(s)	• Early Career Researcher (ECR) • University Members • Quadruple Helix Actors
Benefit for target group(s)	• A fun and interactive experience that also teaches the importance of collaboration • Experience in a realistic way, that each player will have their own agenda and will need to, at times, prioritise this agenda in the way their resources are allocated
Measures / activities / benefits	Main rules: https://www.better-life-digital.eu/wp-content/uploads/2024/03/Rules-of-the-Game.pdf

Unit 3. Enhancing University-Government Partnerships for Greater Impact

Universities and governmental bodies share a crucial, symbiotic relationship, where both entities benefit from the other's resources, expertise, and influence. Strengthening this collaboration is essential for tackling societal challenges, advancing knowledge, and fostering economic growth. The importance of university-government cooperation lies in its ability to address complex societal issues that require multidisciplinary approaches. Governments depend on universities for research insights that inform policy-making, while universities rely on government funding and policy support. Effective collaboration between these institutions leads to the creation of knowledge, technological advancements, and public policies that benefit society as a whole (Bok, 2013).

However, despite the numerous successful partnerships between universities and government bodies, various challenges hinder deeper cooperation. One of the primary challenges is the misalignment of objectives and priorities. Governments often focus on short-term policy goals, while universities are more oriented toward long-term research and education. This difference in focus can lead to conflicts in setting priorities, allocating resources, and achieving the desired outcomes of joint projects (Etzkowitz & Leydesdorff, 2000). Furthermore, bureaucratic barriers in both universities and government agencies can impede collaboration. Lengthy approval processes, rigid regulations, and multiple layers of authorization can slow down the implementation of collaborative projects, particularly in fast-moving fields like technology and innovation, where delays can result in missed opportunities.

Limited communication and engagement are also significant obstacles. Effective collaboration requires ongoing communication between universities and government bodies, but many partnerships suffer from insufficient dialogue, leading to misunderstandings and missed opportunities. Regular communication channels and platforms for dialogue are often lacking, making it difficult to align goals and share information effectively (Etzkowitz & Leydesdorff, 2000). Additionally, funding constraints pose a significant challenge. While governments provide substantial funding to universities, budget limitations and shifting political priorities can impact the sustainability of collaborations. In some cases, funding is tied to specific policy goals, restricting universities' ability to pursue independent research or address broader societal challenges.

To overcome these challenges, universities need to adopt a more proactive approach in their interactions with government bodies. Establishing joint research initiatives that align with government priorities can help bridge the gap between short-term policy needs and long-term academic research. For example, the UK Research and Innovation (UKRI) partnership

brings together public funding agencies and universities to support high-impact research in areas such as climate change and public health (UKRI, 2021). Creating formal communication channels, such as regular meetings, joint committees, and dedicated liaison offices, is essential for ensuring ongoing dialogue and collaboration. The United States' Land-Grant University System, which mandates regular engagement between universities and state governments, illustrates the importance of institutionalized communication channels (Bok, 2013).

Universities can further enhance their cooperation with government bodies by aligning their research agendas with public policy goals. By closely monitoring policy developments and engaging with policymakers, universities can tailor their research to address government priorities, increasing the relevance and impact of their work. Developing research centers focused on policy-relevant topics, similar to the RAND Corporation's collaboration with various governments on defense and public policy research, can serve as a successful model (RAND Corporation, n.d.).

Facilitating knowledge transfer and innovation is another critical strategy. Universities play a key role in the innovation ecosystem by transferring knowledge and technology to the public and private sectors. Governments can support this process by creating favorable regulatory environments, funding technology transfer offices, and incentivizing collaboration between universities and industry. The partnership between Stanford University and the U.S. government on technology transfer initiatives in Silicon Valley highlights the potential of such collaborations to drive economic growth and innovation (Etzkowitz & Leydesdorff, 2000). To address funding constraints, universities should work with governments to develop more flexible and sustainable funding mechanisms. Programs like the European Union’s Horizon Europe, which provides multi-year funding for research and innovation, demonstrate how structured funding can support university-government cooperation (Horizon Europe, 2021).

Universities also have a role in policy advocacy. They can shape public policy by participating in policy development processes, offering expert testimony, publishing policy briefs, and engaging in public consultations. Establishing policy research institutes within universities, such as Harvard University’s Belfer Center for Science and International Affairs, can help bridge the gap between academia and policy-making (Belfer Center for Science and International Affairs, n.d.). Additionally, universities must build public trust by demonstrating transparency and accountability in their research and operations. Initiatives like MIT’s OpenCourseWare, which provides free access to educational materials, have helped build public trust and increase the impact of academic research (MIT OpenCourseWare, n.d.).

How can the public sector influence university-government partnerships ? In very simple terms, public sector actors offer a wide range of platforms and policies that facilitate the engagement of higher education in particpative processes: i.e. policy debates, having academics as advisors, outcsourcing research and studies, participative consultation and so

on. On the other hand, with regards to regional authorities, particularly those in charge of regional policies, they are offering integrated regional decision making mechanisms where universities (as key knowledge and innovatiomn providers) play a crucial role in shaping regional talent ecosystems.

In conclusion, the collaboration between universities and governmental bodies is vital for addressing societal challenges, advancing knowledge, and fostering economic growth. By adopting strategies such as establishing joint research initiatives, creating formal communication channels, aligning research agendas with public policy goals, facilitating knowledge transfer, and enhancing funding mechanisms, universities can improve their cooperation with governments. Moreover, universities should engage in policy advocacy, build public trust, and participate in policy implementation to strengthen this relationship further. As the global landscape becomes increasingly complex, the need for effective university-government cooperation will only grow, making it imperative for both entities to work closely together in pursuit of common goals.

Unit 4. Strengthening University Support for Industrial Cluster Growth

Industrial clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field. These clusters are recognized as powerful engines of economic growth, innovation, and competitiveness. Universities, as centers of knowledge creation and dissemination, play a crucial role in the development and sustenance of these clusters. This essay explores how universities can better support the growth of industrial clusters, with a focus on enhancing collaboration, innovation, and regional development.

4.1. Understanding Industrial Clusters

Industrial clusters are defined by the close proximity of related industries, which can include manufacturers, suppliers, service providers, and research institutions. Michael Porter, a leading scholar on the topic, defines clusters as "geographic concentrations of interconnected companies and institutions in a particular field" that can lead to increased productivity, innovation, and new business formation (Porter, 1998).

Clusters can arise organically or be nurtured through deliberate policy interventions. They often benefit from economies of scale, knowledge spillovers, and a shared labor pool, which collectively enhance the competitive advantage of the firms within the cluster. Prominent examples include Silicon Valley in the United States, the automotive cluster in Stuttgart, Germany, and the aerospace cluster in Toulouse, France.

4.2. The Role of Universities in Industrial Cluster Development

Historically, universities have played a crucial role in regional economic development by acting as knowledge hubs and talent incubators. These institutions are at the forefront of research and innovation, contributing to the generation of new knowledge that can spur technological advancements and economic growth. The Triple Helix model, which underscores the interaction between universities, industry, and government, provides a comprehensive framework for understanding how these entities can collaborate to drive innovation and foster economic development. This model suggests that the synergy between these three spheres can create an environment conducive to the development of industrial clusters, as universities not only produce cutting-edge research but also act as intermediaries, facilitating the transfer of knowledge to industry and influencing regional policy (Leydesdorff

& Etzkowitz, 2015). By playing these multifaceted roles, universities are positioned as key drivers of cluster development, where their contributions extend beyond education and research to include active participation in the economic ecosystem.

As knowledge hubs, universities are essential in generating groundbreaking research that can lead to technological breakthroughs and innovations. This research, when effectively transferred to industry, can drive the development of new products, services, and processes, thus significantly contributing to the competitiveness of industrial clusters. The process of knowledge transfer, which includes activities such as publishing research, filing patents, and engaging in collaborative projects, is critical for ensuring that academic discoveries are translated into practical applications that benefit the economy. Recent studies have highlighted the importance of university-industry collaborations in fostering innovation, noting that regions with strong ties between academic institutions and local industries tend to exhibit higher levels of innovation and economic growth (Perkmann et al., 2021). These collaborations often lead to the creation of new technologies and startups, which can act as catalysts for the growth of industrial clusters by attracting investment and talent to the region.

In addition to their role as knowledge hubs, universities are pivotal in the development of human capital necessary for cluster development. By aligning their curricula with industry needs, universities can ensure that their graduates possess the skills and knowledge required by firms within the cluster. This alignment is particularly important in fields such as science, technology, engineering, and mathematics (STEM), where the demand for skilled labor is high. Universities that maintain close relationships with industry stakeholders are better equipped to adjust their educational offerings to meet the evolving needs of the labor market, thereby enhancing the employability of their graduates and supporting the growth of the cluster. Furthermore, universities serve as neutral grounds where industry players can collaborate on pre-competitive research, share knowledge, and develop innovative solutions to common challenges. This collaborative environment, which often manifests in the form of joint research projects, consortia, and innovation hubs, is crucial for fostering innovation and driving the development of industrial clusters. Studies have shown that such collaborative efforts not only enhance the innovation capacity of the firms involved but also contribute to the overall competitiveness of the region (Benneworth, Pinheiro, & Karlsen, 2017). Thus, universities play a vital role in nurturing the innovation ecosystems that underpin successful industrial clusters.

4.3. Strategies for Enhancing University Support for Industrial Clusters

To better support the growth of industrial clusters, universities can adopt several strategies:

1. **Strengthening Industry-Academia Partnerships**: Universities can enhance their collaboration with industry through joint research initiatives, consortia, and R&D partnerships. These collaborations not only facilitate the transfer of knowledge from academia to industry but also provide universities with valuable insights into the practical challenges faced by industry, which can inform future research directions.
2. **Curriculum and Talent Development**: Universities should design their curricula to align with the current and future needs of industry. This can involve incorporating industry-relevant content, offering specialized training programs, and providing opportunities for students to gain hands-on experience through internships and co-op programs.
3. **Entrepreneurship and Innovation Ecosystems**: Universities can foster entrepreneurship by supporting the creation of spin-offs, start-up incubators, and accelerators. Technology Transfer Offices (TTOs) play a vital role in this process by facilitating the commercialization of university research and supporting the development of new ventures.
4. **Policy Advocacy and Regional Development**: Universities can actively participate in regional development initiatives by advocating for policies that support cluster growth, contributing to the formulation of regional innovation strategies, and engaging in regional development agencies.

4.4. Case Studies of Successful University-Industry Collaborations in Cluster Development

Several case studies illustrate the impact of university-industry collaboration on cluster development:

1. Silicon Valley and Stanford University: Stanford University's role in the development of Silicon Valley is a prime example of how a university can catalyze the growth of an industrial cluster. Through its technology transfer initiatives, entrepreneurial support, and close ties with industry, Stanford has played a central role in the region's emergence as a global innovation hub (Kenney, 2000).

2. Cambridge Cluster (Silicon Fen) and the University of Cambridge: The University of Cambridge has been instrumental in the development of the Cambridge Cluster, also known as Silicon Fen. The university's research excellence, combined with its proactive approach to technology transfer and start-up support, has helped establish the region as a leading center for high-tech industries (Garnsey & Heffernan, 2005).

3. MIT and the Boston Biotech Cluster: The Massachusetts Institute of Technology (MIT) has significantly contributed to the growth of the Boston biotech cluster. Through its strong focus on life sciences research, technology transfer, and collaboration with industry, MIT has helped make the Boston area one of the leading biotech hubs in the world (Powell, Koput, & Smith-Doerr, 1996).

4. RWTH Aachen University and the Aachen Cluster: RWTH Aachen University in Germany has played a crucial role in the development of the Aachen industrial cluster. The university's emphasis on applied research, close collaboration with industry, and involvement in regional innovation networks have made it a key player in the region's economic development (Foray, 2014).

These case studies demonstrate the diverse ways in which universities can contribute to the development of industrial clusters, from fostering innovation and entrepreneurship to shaping regional economic strategies.

4.5. Challenges and Barriers to Effective University Support

Despite the significant contributions that universities can make to cluster development, several challenges and barriers must be addressed to enhance their effectiveness. One of the key issues is the institutional and cultural divide between universities and industry, as they often operate under different priorities and timelines, making it essential to bridge these gaps for effective collaboration. Additionally, funding constraints pose a significant hurdle, as universities frequently face financial limitations that restrict their ability to engage in extensive research and development activities, highlighting the critical need for securing sustainable funding models for university-industry partnerships. Intellectual property (IP) management is another contentious issue in these collaborations, necessitating clear agreements and frameworks to ensure that both parties benefit equitably from the commercialization of research. Moreover, universities must carefully balance the need for academic freedom with the practical demands of industry, a balance that is crucial for maintaining the integrity of academic research while ensuring its relevance to industry needs.

Universities play a pivotal role in the development and growth of industrial clusters. By serving as knowledge hubs, developing talent, fostering innovation, and collaborating with

industry and government, universities can significantly enhance the competitiveness and sustainability of industrial clusters. However, to maximize their impact, universities must address the challenges they face and adopt strategies that promote greater collaboration, innovation, and regional development. As the global economy continues to evolve, the role of universities in industrial cluster development will become increasingly important, making it essential for educational institutions, industry, and policymakers to work together in building the clusters of the future.

Unit 5. Test beds & living labs

In the ever-evolving landscape of research and development, the concepts of test beds and living labs have emerged as pivotal tools for innovation. These environments bridge the gap between theoretical research and practical application, providing a platform where ideas can be tested, refined, and scaled in real-world conditions. Living labs, in particular, have gained traction as a dynamic approach to research that involves collaboration between academia, industry, government, and communities. Unlike traditional research environments, living labs offer a unique opportunity to co-create solutions in a setting that closely mirrors the complexities of real life.

5.1. What is a Living Lab. Definition and Concept

A living lab is a user-centered, open-innovation ecosystem that brings together research and innovation processes within a public-private-people partnership, emphasizing co-creation and real-life experimentation. In these environments, users actively engage in the development process, ensuring that the outcomes are both innovative and aligned with societal needs. Originating in the early 2000s through initiatives by the European Union and global entities, the living lab concept was developed to enhance innovation by creating spaces where stakeholders could collaborate, iterate, and develop solutions in real-world contexts. Key characteristics of living labs include active user involvement, research conducted in real-life settings, participation from multiple stakeholders—such as academia, industry, government, and citizens—and the collaborative development of solutions through iterative prototyping and testing (Almirall & Wareham, 2018; Leminen & Westerlund, 2017).

5.2. Living Labs vs. Traditional Research Environments

Living labs differ significantly from traditional research environments, which typically operate in controlled, isolated settings and follow a linear process where solutions are developed based on hypotheses and tested later in real-world scenarios. In contrast, living labs are dynamic and iterative, enabling experimentation and testing to occur simultaneously within the actual environment where the solutions will be applied. This approach offers several key advantages over traditional research, including enhanced relevance, as solutions are developed and tested in real-world contexts; accelerated innovation, driven by the iterative process of co-creation and real-time feedback; and stronger user engagement, as users who

are involved in the development process are more likely to adopt and support the resulting innovations (Schuurman & De Marez, 2015; Bergvall-Kåreborn & Ståhlbröst, 2018).

5.3. Examples of Living Labs Around the World

Several living labs around the world have demonstrated the power of this approach to innovation. Some notable examples include:

- **The European Network of Living Labs (ENoLL):** A network of living labs across Europe that focuses on various areas of innovation, including smart cities, healthcare, and energy.
- **MIT Media Lab's Living Labs:** Focused on exploring the intersections of technology, design, and everyday life, MIT's living labs have been at the forefront of innovative research in areas such as urban planning and digital technology.
- **Helsinki's Smart City Living Lab:** Part of the larger effort to transform Helsinki into a smart city, this living lab focuses on developing and testing smart city solutions in collaboration with residents, businesses, and public institutions.

5.4. How Can Universities Set Up Living Labs?

The initial phase of establishing a living lab within a university involves clearly defining its objectives and goals, ensuring alignment with the university's broader research agenda while addressing areas of both academic interest and societal need. This process requires identifying specific challenges or opportunities the lab will tackle, such as sustainability, healthcare, digital innovation, or urban planning. Engaging with potential stakeholders—including faculty, students, industry partners, and the community—is crucial for gathering input and building support. Setting measurable goals, such as developing new technologies, creating educational opportunities, or addressing community challenges, is essential for guiding the lab's activities and ensuring its relevance and impact (Schuurman & De Marez, 2015).

Once the objectives are established, designing the infrastructure of the living lab becomes the next critical step. This design encompasses both physical and virtual elements tailored to the nature of the research and the needs of participants. The physical infrastructure might involve creating dedicated spaces like labs, workshops, or co-working areas within the university, designed to be flexible and adaptable for various research activities. In the digital age, virtual components are equally important, including online platforms for collaboration, data sharing, and user interaction, which can extend the reach of the living lab by facilitating remote

participation and broader dissemination of results. The lab should also be equipped with the necessary technology and tools, such as prototyping equipment, sensors, and data analytics tools, to support innovation. Integrating these resources with the university's existing expertise, facilities, and networks is vital for maximizing the lab's effectiveness and impact (Bergvall-Kåreborn & Ståhlbröst, 2018).

Building strong collaborations and partnerships is fundamental to the success of a living lab. Universities should engage a diverse range of stakeholders, including industry partners who can offer resources, expertise, and real-world challenges that help shape the lab's focus. Collaborating with government agencies can align the lab's activities with public policy goals and secure necessary funding or regulatory support, while partnerships with community organizations ensure that the lab's outcomes are grounded in local needs and benefit society at large. Additionally, collaboration with other academic institutions can enhance the lab's capabilities and broaden its impact. The role of multidisciplinary teams in these labs is crucial, as bringing together experts from various fields fosters a holistic approach to problem-solving and innovation. To ensure long-term sustainability, universities must explore diverse funding sources, such as government grants, industry sponsorships, private foundations, and internal university funding. Developing a clear vision and strategy, building strong partnerships, focusing on user-centered design, and maintaining flexibility are all critical for overcoming challenges and securing the lab's future success (Leminen & Westerlund, 2017).

5.5. How Can Research Infrastructure & Test Beds for Industrial Research Be Used in Living Labs?

Test beds serve as a cornerstone within living labs, providing a controlled environment where new technologies, processes, and innovations can be rigorously tested and refined before being deployed in real-world settings. In these contexts, test beds are more than isolated spaces for experimentation—they are integrated into the broader ecosystem of the living lab, contributing to a continuous cycle of innovation. This integration ensures that the solutions developed are not only tested for feasibility but also tailored to meet the specific needs and challenges of the environment in which they will ultimately be applied (Almirall & Wareham, 2018).

One of the primary functions of test beds in living labs is the testing and validation of new ideas. In a controlled environment, researchers can identify potential issues early in the development process and address them before scaling up. This process is crucial because it allows for the refinement of technologies and processes in a way that reduces the risks

associated with real-world implementation. For instance, in smart city projects, test beds can simulate urban environments, enabling the testing of innovations like traffic management systems or energy-efficient buildings under realistic conditions. This rigorous testing helps to ensure that the solutions are viable and can perform effectively when deployed at scale (Leminen & Westerlund, 2017).

In addition to testing and validation, test beds within living labs facilitate rapid prototyping and iteration. This environment enables researchers and developers to create prototypes, test them in near-real-world conditions, gather feedback, and then quickly iterate on their designs. This iterative process is central to the concept of living labs, as it fosters continuous improvement and adaptation. By integrating test beds into this process, living labs can shorten the development cycle, moving innovations from the conceptual stage to market-ready solutions more efficiently. For example, in the development of medical devices, test beds can provide a simulated clinical environment where new products can be tested, refined, and validated in a way that closely mirrors their intended use in healthcare settings (Bergvall-Kåreborn & Ståhlbröst, 2018).

Another critical role of test beds in living labs is data collection and analysis. Equipped with sensors and advanced data analytics tools, test beds can gather detailed information on the performance of new technologies or processes. This data is invaluable for researchers, as it provides insights that inform further development and refinement. In a living lab focused on environmental sustainability, for instance, test beds might collect data on energy consumption, emissions, or resource usage, which can then be analyzed to optimize the design of sustainable technologies. This capability not only enhances the quality of the innovations developed but also ensures that they are grounded in empirical evidence (Schuurman & De Marez, 2015).

The integration of test beds into the larger ecosystem of a living lab is crucial for ensuring that innovations are relevant, scalable, and aligned with the needs of users and society. Test beds do not operate in isolation; they are connected to real-world settings, user participation, and multi-stakeholder collaboration. This interconnectedness is what sets living labs apart from more traditional research environments. By embedding test beds within a living lab, the entire innovation process becomes more holistic, with continuous feedback loops that involve users, industry partners, and other stakeholders. This approach increases the likelihood that the innovations developed will be successful when deployed in the real world (Almirall & Wareham, 2018).

Industrial collaboration is a key component of living labs, and the integration of research infrastructure and test beds can significantly enhance these collaborations. Industry partners bring valuable resources, expertise, and real-world challenges to the table, which can help focus the research and development activities within the living lab. For universities, access to advanced research infrastructure and test beds provided by industry partners can greatly enhance the capabilities of the living lab, enabling more sophisticated experimentation and faster innovation cycles. This collaboration also ensures that the innovations developed are closely aligned with market needs, increasing their potential for commercialization (Leminen & Westerlund, 2017).

Industry involvement in living labs is particularly beneficial when it comes to addressing real-world challenges. Companies often have a deep understanding of the practical issues that need to be solved, which can help direct the focus of research in a living lab. For example, in the context of smart city initiatives, industry partners might highlight challenges related to urban mobility or energy efficiency, guiding the development of technologies that address these specific issues. By working closely with industry, living labs can ensure that the solutions they develop are not only innovative but also have a clear path to market, increasing their impact and sustainability (Bergvall-Kåreborn & Ståhlbröst, 2018).

The collaboration between living labs and industry also facilitates the commercialization of innovations. When test beds within a living lab demonstrate that a technology or process is viable, industry partners are often well-positioned to bring these innovations to market. This can involve scaling up production, securing regulatory approvals, or developing marketing strategies. The close partnership between academia and industry in living labs ensures that the transition from prototype to product is smooth and efficient, helping to accelerate the time it takes for new innovations to reach consumers. This process is particularly evident in sectors like healthcare, where new medical technologies developed in living labs can move quickly from clinical trials in test beds to widespread adoption in healthcare facilities (Schuurman & De Marez, 2015).

There are several real-world applications and case studies that highlight the successful integration of research infrastructure and test beds in living labs. For instance, the Fraunhofer-Gesellschaft Living Labs in Germany focus on applied research in areas such as energy, manufacturing, and healthcare. By integrating test beds into their research infrastructure, these labs have been able to accelerate the development and commercialization of new technologies, demonstrating the powerful role that test beds can play in driving innovation. Another example is the UK's 5G Test Bed and Trials program, which has established living labs across the country to explore the potential of 5G technology. These

living labs bring together universities, industry, and government to test and develop new applications for 5G in areas such as healthcare, transport, and smart cities (Leminen & Westerlund, 2017).

The Living Labs Global Network (LLGN) is another notable example of how test beds can be integrated into living labs to create impactful solutions. This network focuses on developing and testing solutions for sustainable urban development, addressing challenges such as energy efficiency, waste management, and urban mobility. By integrating research infrastructure and test beds into their living labs, the LLGN has been able to develop a range of innovative solutions that are now being implemented in cities around the world. These case studies demonstrate the potential of living labs to drive innovation and create real-world impact by effectively leveraging test beds within their ecosystems (Bergvall-Kåreborn & Ståhlbröst, 2018).

However, the integration of research infrastructure and test beds in living labs is not without its challenges. Coordinating multiple stakeholders and research infrastructures can be complex and requires careful planning and governance. This is particularly true when large industry partners or government agencies are involved, as the differing priorities and expectations of these stakeholders can complicate the collaboration. Furthermore, there is often a need to balance the controlled environment required for accurate testing and validation in test beds with the flexibility and real-world relevance that living labs aim to achieve. This balance is critical to ensuring that the innovations developed are both robust and applicable to real-world settings (Almirall & Wareham, 2018).

To address these challenges, best practices include establishing clear governance structures and processes to coordinate the activities of different stakeholders and ensure the effective operation of the living lab. Emphasizing iterative development and continuous feedback can also help balance the need for control in test beds with the flexibility required in living labs. Additionally, a focus on scalability from the outset is crucial. Living labs should consider how innovations will be scaled up and implemented in real-world settings, which may involve developing partnerships with industry or government to support deployment. By adopting these strategies, living labs can overcome the challenges associated with integrating test beds and maximize their potential to drive innovation and create real-world impact (Leminen & Westerlund, 2017).

Conclusion

In conclusion, this document presents a holistic approach to leveraging universities as key players in regional innovation ecosystems. By offering detailed strategies and practical tools, the instrument supports universities in enhancing their role as drivers of sustainable development. It underscores the importance of collaboration between academia, industry, government, and civil society, facilitated through innovative frameworks such as test beds and living labs. The document emphasizes the need for universities to engage more deeply with external stakeholders, align their research agendas with regional and societal needs, and adopt responsible research and innovation practices. Ultimately, the instrument aims to guide universities in their transformation into entrepreneurial and socially engaged institutions, capable of fostering economic growth, supporting industrial clusters, and contributing to the broader regional development goals in Georgia and beyond.

References

Almirall, E., & Wareham, J. (2018). Living Labs: Arbiters of Mid- and Ground-Level Innovation. Technology Innovation Management Review, 8(3), 27-34.

Aranguren, M. J., Magro, E., Navarro, M., & Wilson, J. R. (2019). Governance of the territorial entrepreneurial discovery process: Looking under the bonnet of RIS3. Regional Studies, 53(4), 451-461.

Asheim, B.T., Isaksen, A., & Trippl, M. (2019). Advanced introduction to regional innovation systems. Elgar Advanced Introductions series. Cheltenham: Edward Elgar Publishing.

Balland, P. A., Boschma, R., Crespo, J., & Rigby, D. L. (2019). Smart specialization policy in the European Union: Relatedness, knowledge complexity and regional diversification. *Regional Studies, 53*(9), 1252-1268.

Belfer Center for Science and International Affairs. (n.d.). About the Belfer Center. Retrieved from https://www.belfercenter.org

Benneworth, P., Charles, D., Conway, C., Hodgson, C., & Humphrey, L. (2009). How the societal impact of universities can be improved both conceptually and practically. European Journal of Education, 44(4), 451-462.

Benneworth, P., Pinheiro, R., & Karlsen, J. (2017). *The role of universities in regional development: Theoretical perspectives and policy implications*. In Theories of Local Economic Development (pp. 277-296). Routledge.

Bergvall-Kåreborn, B., & Ståhlbröst, A. (2018). Living labs: An open and citizen-centric approach for innovation. International Journal of Innovation and Regional Development, 9(3), 267-286.

Bok, D. (2013). Higher Education in America. Princeton University Press.

Cai, Y., Ma, J., & Chen, Q. (2020). Higher education in innovation ecosystems. Sustainability, 12(11), 4376. https://doi.org/10.3390/su12114376

Čajka, P., Čajková, A., & Krpálek, P. (2023). The role of universities as the institutional drivers of innovation at the regional level. Terra Economicus, 21(1), 94–107. https://doi.org/10.18522/2073-6606-2023-21-1-94-107

Carayannis, E. G., Grigoroudis, E., Campbell, D. F., Meissner, D., & Stamati, D. (2018). The ecosystem as helix: An exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. *R&D Management, 48*(1), 148-162.

Carayannis, E.G., & Campbell, D.F.J. (2009). 'Mode 3' and 'quadruple helix': Toward a 21st century fractal innovation ecosystem. International Journal of Technology Management, 46, 201–234. https://doi.org/10.1504/IJTM.2009.023374

Cooke, P. (2004). Regional innovation systems: An evolutionary approach. In P. Cooke, R. Heidenreich, & H.J. Braczyk (Eds.), Regional innovation systems: The role of governance in a globalized world (pp. 1–20).

Crescenzi, R., Filippetti, A., & Iammarino, S. (2019). Academic inventors: Collaboration and proximity with industry. *Journal of Technology Transfer, 44*(3), 868-897.

Doloreux, D., & Parto, S. (2005). Regional innovation systems: Current discourse and unresolved issues. Technology in Society, 27, 133–153.

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From national systems and "mode 2" to a triple helix of university–industry–government relations. Research Policy, 29(2), 109–123. https://doi.org/10.1016/S0048-7333(99)00055-4

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and 'Mode 2' to a Triple Helix of university–industry–government relations. Research Policy, 29(2), 109-123.

European Commission, Directorate-General for Research and Innovation, Peiffer-Smadja, O., Mitra, A., Ravet, J. (2023). The road to success : how regional innovation ecosystems can improve participation in the European Framework Programme for R&I, Publications Office of the European Union. https://data.europa.eu/doi/10.2777/710365

European Commission, Directorate-General for Research and Innovation, European Innovation Scoreboard 2024, Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2777/779689

European Commission, Directorate-General for Research and Innovation, Hollanders, H., Es-Sadki, N., Regional Innovation Scoreboard 2023, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2777/70412

European Commission. (2020). The future of living labs: Advancing open innovation at scale. European Network of Living Labs (ENoLL).

Farinha, L., Ferreira, J. J., Ranga, M., & Santos, D. (2020). Regional helix ecosystems and economic growth. In Studies on entrepreneurship, structural change and industrial dynamics (pp. 1–9). https://doi.org/10.1007/978-3-030-47697-7_1

Federation of American Scientists, 2023, available at: https://fas.org/publication/crs-regional-innovation-ecosystems/

Foray, D. (2014). *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. Routledge.

Foray, D., David, P. A., & Hall, B. H. (2018). Smart specialization: The concept. In R. D. J. Inklaar & M. P. Timmer (Eds.), *Productivity and competitiveness in the European Union* (pp. 23-35). Springer.

Garnsey, E., & Heffernan, P. (2005). *High-technology Clustering through Spin-out and Attraction: The Cambridge Case*. Regional Studies.

Gianelle, C., Kyriakou, D., Cohen, C., & Przeor, M. (2016). *Implementing Smart Specialisation: A Handbook*. European Commission.

Goddard, J., & Vallance, P. (2013). The University and the City. Routledge.

González-López, M., & Asheim, B. T. (2020). Introduction: regional innovation systems and regional innovation policies. In Edward Elgar Publishing eBooks. https://doi.org/10.4337/9781789904161.00005

Guerrero, M., & Urbano, D. (2012). The development of an entrepreneurial university. Journal of Technology Transfer, 37(1), 43-74.

Guzman, J., Murray, F., Stern, S., & Williams, H. (2023). Accelerating Innovation Ecosystems: The promise and Challenges of Regional innovation Engines. https://doi.org/10.3386/w31541

Hoffecker, Elizabeth. 2019. Understanding Innovation Ecosystems: A Framework for Joint Analysis and Action. Cambridge: MIT D-Lab.

Horizon Europe. (2021). The EU Research and Innovation programme (2021-2027). Retrieved from https://ec.europa.eu

Huggins, R., & Williams, N. (2011). Entrepreneurship and regional competitiveness: The role and progression of policy. Entrepreneurship & Regional Development, 23(9–10), 907–932.

Isaksen, A., Martin, R., & Trippl, M. (2018a). New avenues for regional innovation systems and policy. In A. Isaksen, R. Martin, & M. Trippl (Eds.), New avenues for regional innovation systems-theoretical advances, empirical cases and policy lessons (pp. 1–19).

Kenney, M. (2000). *Understanding Silicon Valley: The Anatomy of an Entrepreneurial Region*. Stanford University Press.

Klimas, P., & Czakon, W. (2021). Species in the wild: a typology of innovation ecosystems. Review of Managerial Science, 16(1), 249–282. https://doi.org/10.1007/s11846-020-00439-4

Kroll, H. (2016). Policy impact of smart specialization: Innovation policy and industrial policy need to be coordinated. *Investigaciones Regionales - Journal of Regional Research, 36*(1), 27-41.

Leminen, S., & Westerlund, M. (2017). Categorization of innovation tools in living labs. Technology Innovation Management Review, 7(5), 15-25.

Leydesdorff, L., & Etzkowitz, H. (2015). *The triple helix as a model for innovation studies*. Science and Public Policy, 42(2), 56-66.

Liu, J., Zheng, L., & Zhu, P. (2020). Research on the path of university science and technology innovation serving regional economic development. Proceedings of the 2020 5th International Conference on Modern Management and Education Technology (MMET 2020). https://doi.org/10.2991/assehr.k.201023.090

Magro, E., & Wilson, J. R. (2019). Policy-mix evaluation: Governance challenges from new place-based innovation policies. *Research Policy, 48*(10), 103612.

Marginson, S. (2011). Higher education and public good. Higher Education Quarterly, 65(4), 411-433.

Mariussen, Å., Rakhmatullin, R., Stanionyte, L., & Tomlinson, M. (2019). Smart specialization and governance: A synergy or contradiction? *European Planning Studies, 27*(8), 1587-1604.

McCann, P., & Ortega-Argilés, R. (2016). Smart specialization, entrepreneurship and SMEs: Issues and challenges for a results-oriented EU regional policy. *Small Business Economics, 46*(4), 537-552.

McCann, P., & Soete, L. (2020). Place-based innovation for sustainability. *Environmental Innovation and Societal Transitions, 35*(2), 1-14.

MIT OpenCourseWare. (n.d.). About OCW. Retrieved from https://ocw.mit.edu

O'Shea, R., Allen, T. J., Chevalier, A., & Roche, F. (2007). Delineating the anatomy of an entrepreneurial university: The MIT experience. R&D Management, 37(1), 1-16.

OECD reviews of regional innovation. (2023). OECD Reviews of Regional Innovation. https://doi.org/10.1787/19976585

Peris-Ortiz, M., Farinha, L., Ferreira, J. J., & Fernandes, N. O. (Eds.). (2016). Multiple Helix ecosystems for sustainable competitiveness. Cham: Springer.

Peris-Ortiz, M., Gómez, J. A., Merigó-Lindahl, J. M., & Rueda-Armengot, C. (2017). Entrepreneurial universities. In Innovation, technology and knowledge management. https://doi.org/10.1007/978-3-319-47949-1

Perkmann, M., & Walsh, K. (2007). University–industry relationships and open innovation: Towards a research agenda. International Journal of Management Reviews, 9(4), 259-280.

Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., ... & Sobrero, M. (2021). *Academic engagement and commercialisation: A review of the literature on university–industry relations*. Research Policy, 50(1), 104-125.

Pontikakis, D., Gonzalez Vazquez, I., Bianchi, G., Ranga, L., Marques Santos, A., Reimeris, R., Mifsud, S., Morgan, K., Madrid Gonzalez, C. and Stierna, K. (2022). Partnerships for Regional Innovation Playbook, EUR 31064 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-52325-3, doi:10.2760/775610, JRC129327.

Porter, M. E. (1998). *Clusters and the New Economics of Competition*. Harvard Business Review.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). *Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology*. Administrative Science Quarterly.

Radosevic, S., & Stancova, K. C. (2018). Internationalising smart specialization: Assessment and issues in the EU-13. *Journal of the Knowledge Economy, 9*(1), 263-293.

RAND Corporation. (n.d.). About the RAND Corporation. Retrieved from https://www.rand.org

Rasmussen, E., & Sørheim, R. (2006). Action-based entrepreneurship education. Technovation, 26(2), 185-194.

Regional innovation scoreboard, EC, 2023, https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/regional-innovation-scoreboard_en

Rodríguez-Pose, A., & Wilkie, C. (2017). Institutions and the entrepreneurial discovery process for smart specialization. *Regional Studies, 51*(3), 476-489.

Rodríguez-Pose, A., & Wilkie, C. (2019). Innovating in less developed regions: What drives patenting in the lagging regions of Europe and North America. Growth and Change, 50(1), 4–37. https://doi.org/10.1111/grow.12280

Sachs, J., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., & Rockström, J. (2019). Six transformations to achieve the sustainable development goals. Nature Sustainability, 2(9), 805-814.

Saiz-Santos, M., La Mata, A. A., & Hoyos-Iruarrizaga, J. (2016). Entrepreneurial University: educational innovation and technology transfer. In Innovation, technology and knowledge management (pp. 105–121). https://doi.org/10.1007/978-3-319-47949-1_7

Scafarto, V., Ricci, F., Moscarini, F., & Della Corte, G. (2019). Analysing the concept of ccosystem: a systematic literature review. PROCEEDINGS IFKAD..., 717-726.

Schuurman, D., & De Marez, L. (2015). Structuring user involvement in panel-based living labs. Technology Innovation Management Review, 5(1), 23-29.

Thomas, E., Faccin, K., & Asheim, B. T. (2020). Universities as orchestrators of the development of regional innovation ecosystems in emerging economies. Growth and Change, 52(2), 770–789. https://doi.org/10.1111/grow.12442

Tödtling, F., & Trippl, M. (2018). Regional innovation policies for new path development – beyond neo-liberal and traditional systemic views. *European Planning Studies, 26*(9), 1779-1795.

UK Research and Innovation (UKRI). (2021). UKRI Strategy 2021-2025: Transforming tomorrow together. Retrieved from https://www.ukri.org

Watson, D., Hollister, R. M., Stroud, S. E., & Babcock, E. (2011). The Engaged University: International Perspectives on Civic Engagement. Routledge.

Wiyono, L. C., Mahanani, R. S., & Kurniawan, B. P. Y. (2022). Local Economic Development Strategies to accelerate sustainable economic growth. *Advances in Social Science, Education and Humanities Research/Advances in Social Science, Education and Humanities Research*. https://doi.org/10.2991/assehr.k.220207.016

World Economic Forum. (2022). 4 ways to make economic growth sustainable, resilient and inclusive. *World Economic Forum*.

Zhao, Y., Gao, Y., & Hong, D. (2024). Sustainable Innovation and Economic resilience: Deciphering ESG ratings' role in lowering debt financing costs. Journal of the Knowledge Economy. https://doi.org/10.1007/s13132-024-02129-y

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Responsible and Impactful Universities as Sustainable Growth and Enterprise Catalysts in Georgia

Ecosystem transformation for sustainable and responsible job creation and enterprise

Instrument 6

TUM International

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